REMARKS

The present application is the United States National Stage of international application no. PCT/KR00/00899. The claims in this United States National Stage application have been amended to solely to expedite the examination of application. The applicant presents the claims as amended without waiving the right to add claims such as dependent claims or increase the dependency of the claims already disclosed herein as part of a subsequent division, continuation, continuation-in-part application, or similar application. The enclosed fee sheet is based on the claims submitted after this preliminary amendment.

Version With Markings To Show Changes Made. Pursuant to 37 C.F.R. §1.121, the applicant submits a marked up version of the claims to show changes made beginning on the next full page:

1. A fiber optic cable for a wavelength division multiplexing (WDM) optical transmission system including a plurality of connected optical fibers, wherein each of the connected optical fibers is formed of a plurality of optical fibers respectively exhibiting different dispersion values and different dispersion slopes in a predetermined operating wavelength range while having different lengths and different effective areas, the optical fibers being connected to one another in an optional order.

2. The fiber optic cable according to claim 1, wherein the different dispersion values and different lengths of the optical fibers in each of the connected optical fibers are controlled so that the connected optical fiber has an average dispersion value corresponding to a value required in the WDM optical transmission system.

3. The fiber optic cable according to claim 1, wherein the different dispersion values, different slopes, and different lengths of the optical fibers in each of the connected optical fibers are controlled so that the connected optical fiber has an average dispersion slope corresponding to a value required in the WDM optical transmission system.

4. The fiber optic cable according to claim 1, wherein the different effective areas and different' lengths of the optical fibers in each of the connected optical fibers are controlled so that the connected optical fiber has an average effective area corresponding to a value required in the WDM optical transmission system.

5. The fiber optic cable according to [any one of] claim[s] 1 [to 4], wherein at least a part of the different dispersion values are +2 ps/nm-ln or more, and at least the other part of the different dispersion values are -2 ps/nm-km or less.

6. The fiber optic cable according to claim 5, wherein the optical fibers of each of the connected optical fibers are connected to one another in such a fashion that adjacent ones of the optical fibers have dispersion values of opposite signs, respectively, while exhibiting a dispersion

value difference of at least 10 ps/nm-km there between.

7. The fiber optic cable according to [any one of] claim[s] 1 [to 4], wherein each of the connected optical fibers has a length of 0. 5 to 20 km.

8. A fiber optic cable for a wavelength division multiplexing (WDM) optical transmission system including a plurality of connected optical fibers, wherein each of the connected optical fibers comprises: a first optical fiber exhibiting a first dispersion value and a first dispersion slope in a predetermined operating wavelength range while having a first length and a first effective area; and a second optical fiber exhibiting a second dispersion value and a second dispersion slope in the predetermined operating wavelength range while having a second length and a second effective area; the first and second optical fibers being connected together in an optional order.

9. The fiber optic cable according to claim 8, wherein the first dispersion value and first length of the first optical fiber and the second dispersion value and second length of the second optical fiber are controlled so that an associated one of the connected optical fibers has an average dispersion value corresponding to a value required in the WDM optical transmission system.

10. The fiber optic cable according to claim 8, wherein the first dispersion value, first dispersion slope, and first length of the first optical fiber and the second dispersion value, second dispersion slope, and second length of the second optical fiber are controlled so that an associated one of the connected optical fibers has a dispersion value corresponding to a value required in the WDM optical transmission system.

11. The fiber optic cable according to claim 8, wherein the first length and first effective area of the first optical fiber and the second length and second effective area of the second optical fiber are controlled so that an associated one of the connected optical fibers has an effective area corresponding to a value required in the WDM optical transmission system.

12. The fiber optic cable according to claim 9, wherein the first dispersion value of the first optical fiber, the second dispersion value of the second optical fiber, and the average dispersion value of the associated connected optical fiber are function of an operating wavelength (λ), and the. average dispersion value of the connected optical fiber is determined by the following equation:

$$D_{cf}(\lambda) = \frac{D_1(\lambda)l_1 + D_2(\lambda)l_2}{l_1 + l_2}$$

In the equation,

"D_{cf}" represents the average dispersion value (ps/nm-km) of the connected optical fiber;

"'D_1" represents the first dispersion value (ps/nm-km) of the first optical fiber;

"D_2" represents the second dispersion value (ps/nm-km) of the first optical fiber;

"1_1" represents the first length (km) of the first optical fiber; and

"1_2" represents the second length (Ian) of the second optical fiber.

13. The fiber optic cable according to claim 10, wherein the first dispersion value and first dispersion slope of the first. optical fiber, the second dispersion value and second dispersion slope of the second optical fiber, and the dispersion value and dispersion slope of an associated one of the connected optical fibers are function of an operating wavelength (λ), and the dispersion value of the connected optical fiber is determined by the following equation:

$$S_{cf}(\lambda)=\frac{\partial D_{cf}(\lambda)}{\partial \lambda}=\frac{\frac{\partial D_1(\lambda)}{\partial \lambda}l_1+\frac{\partial D_2(\lambda)}{\partial \lambda}l_2}{l_1+l_2}=\frac{S_1(\lambda)l_1+S_2(\lambda)l_2}{l_1+l_2}$$

In the equation,

"S_{cf}" represents the dispersion slope (ps/rm^2-km) of the connected optical fiber;

"D_{cf}" represents the average dispersion value (ps/nm-km) of the connected optical fiber;

"D_1" represents the first dispersion value (ps/nm-kn) of the first optical fiber;

"D_2" represents the second dispersion value (ps/nm-km) of the first optical fiber;

"S_1" represents the first dispersion slope (ps/nm^2-km)) of the first optical fiber;

"S_2" represents the second dispersion slope (ps/nm^2-km) of the second optical fiber;

"l_1" represents the first length (km) of the first optical fiber; and

"l_2" represents the second length (km) of the second optical fiber.

14. The fiber optic cable according to claim 11, wherein the effective area of the connected optical fiber is fiber; determined by the following equation:

$$A_{cf} = \frac{L_1 L_2 - 1}{\frac{\alpha_3}{\alpha_1}\frac{L_1 - 1}{A_1} + \frac{\alpha_3}{\alpha_2}\frac{L_1(L_2 - 1)}{A_2}}$$

In the equation,

"A_{cf}" represents the effective connected optical fiber;

"l_1" represents the first length optical fiber;

"l_2" represents the second length (km) of the second optical fiber;

"α_1" represents a loss index (/km) of the first optical fiber;

"α_2" represents a loss index (/km) of the second optical fiber;

"α_3" is expressed by "$\alpha_3 = \frac{\alpha_1 l_1 + \alpha_2 l_2}{l_1 + l_1}$";

"α_1" is expressed by "$\alpha_1 = 0.1 \times a_1 \times \log(10)$"

"α_2" is expressed by "$\alpha_1 = 0.1 \times a_2 \times \log(10)$"

"a_{1}" represents a loss coefficient (dB/km) of the first optical fiber;

"a_{1}" represents a loss coefficient (dB/km) of the second optical fiber;

"L1" is expressed by "$L_1 = \exp(-\alpha_1 l_1)$"; and

:L1" is expressed by "$L_2 = \exp(-\alpha_2 l_2)$"; "L1" is expressed by "$L_1 = \exp(-\alpha_1 l_1)$"; and

"L2" is expressed by "$L_2 = \exp(-\alpha_2 l_2)$".

15. The fiber optic cable according to [any one of]claim[s] 8 [to 14], wherein the first and second dispersion values have opposite signs, respectively, while exhibiting a difference of at least 10 ps/nm-km there between.

16. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first dispersion slope has a positive value, and the second dispersion slope has a negative value.

17. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first and second dispersion slopes have positive values, respectively.

18. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first dispersion value of the first optical f iber ranges from +4 ps/nm-km to +20 ps/nm-Km at a central wavelength in the operating wavelength range, and the second dispersion value of the second optical fiber ranges from -20 ps/nm-kn to -4 ps/nm-km at the central wavelength in the operating wavelength range.

19. The fiber optic cable according to claim 18, wherein the first dispersion value ranges from 15 ps/nm-km to 18 ps/m-km, and the second dispersion value ranges from -12 ps/nm-km to -9 ps/nm-kn.

20. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first dispersion slope has a value of +0.1 ps/nm^2-km or less, and the second dispersion slope has a value of -0.1 ps/nm^2-km.

21. The fiber optic cable according to [any one of]claim[s] 8 [to 14], wherein the first and second dispersion slopes have values of +0. 1 ps/rm^2-km or less, respectively.

22. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first effective area ranges from 50 μm^2 to 90 μm^2, and the second effective area ranges from 30 μm^2 to

80 μm^2.

23. The fiber optic cable according to claim 19, wherein the first and second lengths of the first and second optical fibers range from 3 km to 6 km, respectively.

24. The fiber optic cable according to [any one of]claim[s] 8 [to 14], wherein the first and second optical fibers exhibit a dispersion value of 0 in a wavelength range of 1, 300 to 1, 550 nm.

25. The fiber optic cable according to [any one of] claim[s] 8 [to 14], wherein the first optical fiber exhibits a dispersion value of 0 in a wavelength range of 1,300 to 1,500 nm, and the second optical fiber exhibits a dispersion value of 0 at a wavelength of 1,600 nm or more.

26. A fiber optic cable for a wavelength division multiplexing (WDM) optical transmission system including a plurality of connected optical fibers, wherein each of the connected optical fibers comprises:

a first optical fiber exhibiting a first dispersion value and a first dispersion slope in a predetermined operating wavelength range while having a first length and a first effective area;

a second optical fiber exhibiting a second dispersion value and a second dispersion slope at the predetermined operating wavelength range while having a second length and a second effective area; and

a third optical fiber exhibiting the first dispersion value and the first dispersion slope at the predetermined operating wavelength range while having a third length and the first effective area;

the first optical fiber, the second optical fiber, and the third optical fiber being connected to one another in this order.

27. The fiber optic cable according to claim 26, wherein the first dispersion value and first length of the first optical fiber, the second dispersion value and second length of the second optical

fiber, and the first dispersion value and third length of the third optical fiber ar6 controlled so that an associated one of the connected optical fibers has an average dispersion value corresponding to a value required in the WDM optical transmission system.

28. The fiber optic cable according to claim 26, wherein the first dispersion value, first dispersion slope, and first length of the first optical fiber, the second dispersion value, second dispersion slope, and second length of the second optical fiber, and the first dispersion value, first dispersion slope, and third length of the third optical fiber are controlled so that an associated one of the connected optical fibers has a dispersion value corresponding to a value required in the WDM optical transmission system.

29. The fiber optic cable according to claim 26, wherein the first length and first effective area of the first optical fiber, the second length and second effective area of the second optical fiber, and the third length and first effective area of the third optical fiber are controlled so that an associated one of the connected optical fibers has an effective area corresponding to a value required in the WDM optical transmission system.

30. The fiber optic cable according to claim 27, wherein the first dispersion value of the first and third optical fibers, the second dispersion value of the second optical fiber, and the average dispersion value of the associated connected optical fiber are function of an operating wavelength (λ) and the average dispersion optical fiber is determined by value of the following equation:

$$D_{cf}(\lambda)=\frac{D_1(\lambda)l_1+D_2(\lambda)l_2+D_1(\lambda)l_3}{l_1+l_2+l_3}$$

In the equation,

"D_{cf}" represents the average dispersion value (ps/nm-km) of the connected optical fiber;
"D_1" represents the first dispersion value (ps/nm-km) of the first optical fiber;
"D_2" represents the second dispersion value (ps/nm-km) of the first optical fiber;

"l_1" represents the first length (]an) of the first optical fiber;

"l_2" represents the second length (km) of the second optical fiber; and

"l_3" represents the third length (]an) of the third optical fiber.

31. The fiber optic cable according to claim 28, wherein the first dispersion value and first dispersion slope of the first and third optical fibers, the second dispersion value and second dispersion slope of the second optical fiber, and the average dispersion value and dispersion slope of an associated one of the connected optical fibers are function of an operating wavelength (λ), and the dispersion value of the connected optical fiber is determined by the following equation:

$$S_{cf}(\lambda)=\frac{\partial D_{cf}(\lambda)}{\partial\lambda}=\frac{\frac{\partial D_1(\lambda)}{\partial\lambda}l_1+\frac{\partial D_2(\lambda)}{\partial\lambda}(\lambda)l_2+\frac{\partial D_1(\lambda)}{\partial\lambda}l_3}{l_1+l_2+l_3}=\frac{S_1(\lambda)l_1+S_2(\lambda)l_2+S_1(\lambda)l_3}{l_1+l_2+l_3}$$

In the equation,

"S_{cf}" represents the dispersion slope (ps/nm^2-km) of the connected optical fiber;

D_{cf}" represents the average dispersion value (ps/nm-km) of the connected optical fiber;

"D_1" represents the f irst dispersion value (ps/nm-km) of the first optical fiber;

"D_2" represents the second dispersion value (ps/nm-kn) of the first optical fiber;

"l_1" represents the f irst length (km) of the first optical fiber;

"l_2" represents the second length (km) of the second optical fiber.

"l_3" represents the third length (km) of the third optical fiber.

"S_1" represents the f irst dispersion slope (ps/nm^2-km) of the first optical fiber; and

"S_2" represents the second dispersion slope (ps/nm^2-km) of the second optical fiber.

32. The fiber optic cable according to claim 29, wherein the effective area of the connected optical fiber is determined by the following equation:

In the equation,

$$A_{cf}=\frac{L_1L_2L_3-1}{\frac{\alpha_3}{\alpha_1}\frac{(L_1-L_1L_2+L_1L_2L_3-1)}{A_1}+\frac{\alpha_3}{\alpha_2}\frac{L_1(L_2-1)}{A_2}}$$

"A_{cf}" represents the effective connected area (μm2) of the connected optical fiber;

"l_1" represents the first length (km) of the first optical fiber;

"l_2" represents the second length (km) of the second optical fiber;

"l_3" represents the third length (km) of the third optical fiber;

"α_1" represents a loss index (/km) of the first optical fiber;

"α_2" represents a loss index (/km) of the second optical fiber;

"α_3" is, express ed by " "$\alpha_3=\frac{\alpha_1 l_1+\alpha_2 l_2+\alpha_1 l_3}{l_1+l_1+l_3}$ (/km)";

"α_1" is expressed by "α_1 = 0.1 x a_1 x log (10)";

"α_2" is expressed by "α2 = 0.1 x a_1 x log (10)";

"a_{1}" represents a loss coefficient (dB/km) of the first optical fiber;

"a_{2}" represents a loss coefficient (dB/km) of the second optical fiber;

"L1" is expressed by "L_1 = exp($-a_1 1_1$)";

"L2" is expressed by "L_2 = exp($-a_2 1_2$)"; and

"L1" is expressed by "L_3 = exp($-a_3 1_3$)".

33. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first and second dispersion values have opposite signs, respectively, while exhibiting a difference of at least 10 ps/nm-km there between.

34. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first dispersion slope has a positive value, and the second dispersion slope has a negative value.

35. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first and second dispersion slopes have positive values, respectively.

36. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first dispersion value of the first optical fiber ranges from +4 ps/nm-km to +20 ps/nm-km at a central wavelength in the operating wavelength range, and the second dispersion value of the second optical fiber ranges from -20 ps/nm-km to -4 ps/nm-km at the central wavelength in the operating wavelength range.

37. The fiber optic cable according to claim 36, wherein the first dispersion value ranges from 15 ps/nm-km to 18 ps/nm-km, and the second dispersion value ranges from - 12 ps/nm-km to -9 ps/nm-km.

38. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first dispersion slope has a value of +0.1 ps/nm^2-km or less, and the second dispersion slope has a value of -0.1 ps/nm^2-km.

39. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first and second dispersion slopes have values of +0.1 ps/nm^2-km or less, respectively.

40. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first effective area ranges from 50 μm^2 to 90 μm^2, and the second effective area ranges from 30 μm^2 to 80 μm^2.

41. The fiber optic cable according to claim 37, wherein the first, second, and third lengths range from 3 km to 6 km, respectively.

42. The fiber optic cable according to [any one of] claims 26 [to 32], wherein the first, second, and third optical fibers exhibit a dispersion value of 0 in a wavelength range of 1,300 to 1,500 nm.

43. The fiber optic cable according to [any one of] claim[s] 26 [to 32], wherein the first

optical fiber exhibits a dispersion value of 0 in a wavelength range of 1,300 to 1,500 nm, and the second optical fiber exhibits a dispersion value of 0 at a wavelength of 1,600 nm or more.

44. The fiber optic cable according to claim 1[, 8, or 26,] wherein the connected optical fiber has an average dispersion value ranging from 1 ps/nm-km to lO ps/nm-km.

45. The fiber optic cable according to claim 1, [8, or 26,] wherein the operating wavelength range is selected from the group consisting of a range from 1,300 nm to 1,530 nm, a range from 1,400 nm to 1,565 nm, and a range from 1,530 nm to 1,650 nm.

46. A wavelength division multiplexing (WDM) optical transmission system having a predetermined channel spacing and a predetermined number of channels, comprising:

a transmitting terminal for providing a plurality of optical signals respectively having different wavelengths;

a multiplexer connected to the transmitting terminal and adapted to multiplex the optical signals;

a plurality of fiber optic cables each including a plurality of connected optical fibers, each of the connected optical fibers being formed of a plurality of optical fibers respectively exhibiting different dispersion values and different dispersion slopes in a predetermined operating wavelength range while having different lengths and different effective areas, the optical fibers being connected to one another in an optional order;

connecting means for interconnecting the fiber optic cables;

optical amplifiers for amplifying the optical signal being transmitted through the fiber optic cables;

a demultiplexer for demultiplexing the optical signal transmitted through the fiber optic cables; and

a receiving terminal connected to the demultiplexer and adapted to receive the demultiplexed optical signal.

47. A wavelength division multiplexing (WDM) optical transmission system having a predetermined channel spacing and a predetermined number of channels, comprising:

a transmitting terminal for providing a plurality of optical signals respectively having different wavelengths;

a multiplexer connected to the transmitting terminal and adapted to multiplex the optical signals;

a plurality of fiber optic cables each including a plurality of connected optical fibers, each of the connected optical fibers including a first optical fiber exhibiting a first dispersion value and a first dispersion slope in a predetermined operating wavelength range while having a first length and a first effective area, and a second optical fiber exhibiting a second dispersion value and a second dispersion slope in the predetermined operating wavelength range while having a second length and a second effective area, the first and second optical fibers being connected together in an optional order.

connecting means for interconnecting the fiber optic cables;

optical amplifiers for amplifying the optical signal being transmitted through the fiber optic cables;

a demultiplexer for demultiplexing the optical signal transmitted through the fiber optic cables; and

a receiving terminal connected to the demultiplexer and adapted to receive the demultiplexed optical signal.

48. A wavelength division multiplexing (WDM) optical transmission system having a predetermined channel spacing and a predetermined number of channels, comprising:

a transmitting terminal for providing a plurality of optical signals respectively having different wavelengths; a multiplexer connected to the transmitting terminal and adapted to multiplex the optical signals;

a plurality of fiber optic cables each including a plurality of connected optical fibers, each of the connected optical fibers including a first optical fiber exhibiting a first dispersion value and a first dispersion slope in a predetermined operating wavelength range while having a first length and a first effective area, a second optical fiber exhibiting a second dispersion value

and a second dispersion slope at the predetermined operating wavelength range while having a second length and a second effective area, a third first dispersion value and the the predetermined operating wavelength range while having a third length and the first effective area, the first optical fiber, the second optical fiber, and the third optical fiber being connected to one another in this order.

connecting means for interconnecting the fiber optic cables; optical amplifiers for amplifying the optical signal being transmitted through the fiber optic cables;

a demultiplexer for demultiplexing the optical signal transmitted through the fiber optic cables; and

a receiving terminal connected to the demultiplexer and adapted to receive the demultiplexed optical signal.

49. The WDM optical transmission system according to [any one of] claims 46 [to 48], wherein the channel spacing is 50 GHz.

50. The WDM optical transmission system according to [any one of] claims 46 [to 48], wherein the channel spacing is 100 GHz or more.

51. The WDM optical transmission system according to claim 47,wherein the connecting means connects the first optical fiber of a selected one of the fiber optic cables to the first optical fiber of another one of the fiber optic cables adjacent to the first optical fiber of the selected fiber optic cable while controlling a length of the resultant connected first optical fiber.

52. The WDM optical transmission system according to claim 47, wherein the connecting means connects the first optical fiber of a selected one of the fiber optic cables to the second optical fiber of another one of the fiber optic cables adjacent to the first optical fiber of the selected fiber optic cable on an optical line.

53. The WDM optical transmission system according to claim 48, wherein the connecting means connects the first optical fiber of a selected one of the fiber optic cables to the first optical

fiber of another one of the fiber optic cables adjacent to the first optical fiber of the selected fiber optic cable while generating a minimum connection loss.

54. The WDM optical transmission system according to claim 48, wherein the connecting means connects the third optical fiber of a selected one of the fiber optic cables to the first optical fiber of another one of the fiber optic cables adjacent to the third optical fiber of the selected fiber optic cable while generating a minimum connection loss.

CONCLUSION

The applicant requests entry and examination of the claims as preliminarily without waiving any right to have the claims as originally recited examined in this or a subsequent application.

Dated this 13 day of February, 2002.

Respectfully submitted,

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